Advanced Separation: Working to Improve Health Care

One of the major challenges facing medical and pharmaceutical researchers is separating different cells, and cell components, from one another. The ability to do this accurately and reliably is critical to the understanding of biological processes and the development of new and improved treatments for a variety of maladies.

The ADvanced SEParation (ADSEP) commercial payload is making use of major advances in separation technology — obtained through previous research by Space Hardware Optimization Technology (SHOT), Inc., with the Consortium for Materials Development in Space (CMDS), a NASA Commercial Space Center — to support three major commercial investigations: The Phase Partitioning Experiment (PPE); the Microencapsulation experiment; and the Hemoglobin Separation Experiment (HSE).

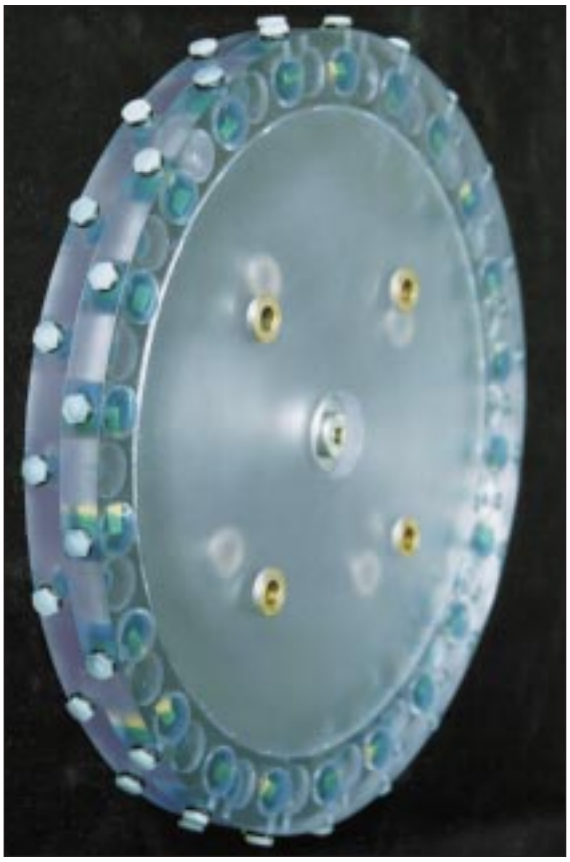
Courtesy: SHOT, Inc.

The ADSEP payload provides advanced separation technology to commercial researchers.

PPE research has the potential to help advance a variety of medical treatments, including that for diabetes, through the development and refinement of cell isolation procedures. In diabetes treatment, for example, the challenge is to isolate cells that produce insulin from the rest of the pancreas so they can be studied or even implanted in advanced procedures. Using ADSEP, commercial researchers will attempt to determine the partition coefficients for model particles in a two-phase system. With this information, researchers can develop a higher resolution, more effective cell isolation procedure that can be used for many different types of research, and for improved health care.

Microencapsulation has the potential to provide a number of novel treatments for diseases ranging from diabetes to cancer. With cancer, microencapsulated drugs could provide more potent treatments while reducing the side effects of chemotherapy. On STS-95, researchers with the Institute for Research, Inc., and NASA Johnson Space Center's Biotechnology Science Office will be investigating the effects of intermittent mixing, which should result in a larger number of high-quality microcapsules. The primary microcapsule being produced will encapsulate two complementary drugs, an antitumor drug and an immune stimulant, to create a potent time-released drug for colon cancer treatment. The data gained from this research will help advance microencapsulation technology and lead to improved treatments.

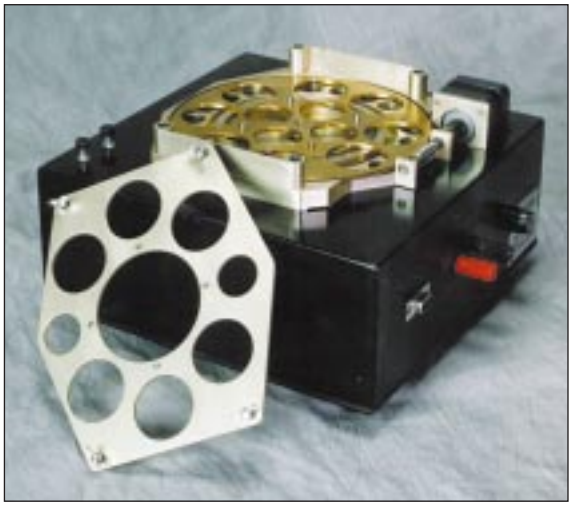
Whole blood suffers from many shortcomings when used for transfusions: it can carry diseases, has a short shelf life, requires special handling, and is very hard to get because of the scarcity of donors. Recombinant human hemoglobin, a synthetic blood substitute, does not share these problems and research on STS-95 will be used to



Courtesy: SHOT, Inc.

Plates like this, located in the cassettes, allow up to 22 stages of processing.

improve the process for ground-based manufacturing of blood substitute products. The HSE will separate recombinant hemoglobin from a solution produced in a ground-based manufacturing process, using aqueous two-phase partitioning, which depends on surface energy to drive the process. The data gathered will be compared with the results of ground-based separation processes, that are driven by density, to improve the volume and purity of the recombinant hemoglobin recovered.



Courtesy: SHOT, Inc.

Advanced technology is brought down to Earth in this commercially available lab unit.

These complex investigations are being run with minimal crew involvement because of the built-in automation and telemetry capabilities of the ADSEP hardware. Each experiment fits in a special cassette that contains the materials being investigated, the experiment hardware, and the instructions for processing the experiment. Operations begin when a crewmember takes the cassettes out of storage and inserts them into the processing unit, called BIOFAC for BIOprocessing FACility. This unit can hold three cassettes at a time in its thermally controlled environment, with each cassette performing independent investigations. Once installed, operations begin automatically, then are monitored and controlled from the ground. Once processing is completed, a crewmember removes the cassette and places it in storage for analysis after landing.

ADSEP allows up to 22 stages of processing to be performed, including mixing, separation, and indexing of the samples. The advanced separation technology is already being made available for use in ground-based laboratories.

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